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APPLICATION OF CLUSTER ANALYSIS FOR IDENTIFICATION OF PLANNING REGIONS IN UTTAR PRADESH

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INTRODUCTION

The problem of regional imbalances in the level of development has been one of the major concerns of the Government since inception of the Second Five Year Plan in India. Attention has been focused on this problem in successive Five Year Plans and it has also attracted some active theoretical discussions, empirical research and specially political concern in recent years. But the problem of regional imbalances still continues to be an urgent and sensitive strategic issue.

At the national level, the fact that inter-state disparities were widening was recognised during the period of the Second Five Year Plan, but no concrete measures were recommended except laying an emphasis on undertaking certain studies which could help in developing suitable indicators for measuring the levels of development and thereby assessing

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the extent of regional disparities. Till the end of the Third Five Year Plan, although statements were made in official documents regarding the balanced regional development and the need for dispersal and diversification of economic activities, the problem of identification of backward areas and the nature of activities that have to be contemplated for such areas on the basis of their problems and potentialities could not receive due weightage. The Fourth Five Year Plan, however, took note of these imbalances and conceived of the allocation of central assistance and the promotion of industries as the major instruments for narrowing down the disparities. A new approach known as Gadgil's formula was devised for allocation of central assistance to different states giving relatively higher weightage to backward areas. The Fifth Plan conceived of accelerated development of backward areas as a cooperative endeavour in which the state governments were expected to play the pivotal role and the central government, corporate financial institutions and the private sector had to make their contributions in accordance with a well formulated and integrated plan of action. Consequently, areas with unfavourable physico-geographic conditions and those economically backward were selected for carrying out special area development programme like Small Farmers Development Agency (SFDA) and Drought Prone Area Programme (DPAP).

In Uttar Pradesh, the first step in the direction of finding out concrete solution to the problem of regional

imbalances was taken up towards the end of the Third Five Year Plan. The state was divided into five broad agro-climatic regions viz., the Western, the central, the Eastern, the Hills and the Bundelkhand, out of which the latter three were identified as backward regions. Since then the State Government have been assigning higher weightage to these backward regions especially in allocation of financial resources.

During the Fourth Plan, the Planning Commission recommended district as a unit for planning with a view to achieving the maximum possible exploitation of local resources and solving the problem of regional imbalances. Thus, the district planning was considered to be the corner stone of the strategy for reducing regional disparities and providing special treatment to the problem of backwardness. In pursuance of the national policy, the need to operationalise the concept of planning from below was emphaised at the state level also. Accordingly, guidelines were issued to prepare firstly village plans on the basis of the requirements listed by the Gram Sabhas and then to collect these plans at the block level and formulate block plans which were later put together as district plans.[1] The need for preparation of district plans as an integral part of the State Plan was re-emphasised during the Fifth Plan. However, owing to lack of proper evaluation of the existing physical resources, formulation of strategies and determination of priorities, technical expertise/competence and a clear cut exposition of resource constraints, the plans received from below were essentially a collection of the

'felt needs of the people' and generally covered those items in which state had to provide for either financial or personnel resources.

In spite of allocation of larger resources to backward regions, launching of special area development programmes and formulation of district plans, the pace of development in these regions has been far below the expectations especially in relation to raising of income levels of the people. The main reason is that regional development has been conceived of as merely allocating higher financial outlays for backward areas, and formulation of strategies for regional development taking into account the dynamic view of resource potentials has never been attempted. The present system is entirely based on the application of uniform strategy for the development of different districts and the adoption of fragmented and sectoral approach to planning without giving due weightage to the distribution of various kinds of development potentials and the requirements of an area.[2]

Consequently, given the existing agro-climatic conditions of different regions, the disparities instead of getting reduced have widened considerably in U.P. particularly during the period 1968-76. The coefficient of variation used as a measure of regional disparities increased among districts from 13 per cent to 20 per cent in relation to the per capita net output from commodity producing sectors. The corresponding increase in case of the value of agricultural produce per ha.

of net area sown was from 23 per cent to 89 per cent and that of length of pucca roads per lakh of population from 30 per cent to 75 per cent.[3] So far as the existing inter-regional disparities are concerned, the value of agricultural produce per ha. of net area sown during 1972-73 was the highest (Rs.2,490) in Western region and the lowest (Rs.1,290) in Bundelkhand region as against the corresponding value of Rs.2,010 for the State. Similarly, the value of industrial output per industrial worker during 1973-74 was maximum (Rs.43,880) in Western region and minimum (Rs.12,490) in Bundelkhand region, whereas the corresponding value for the whole state amounted to Rs.39,180. These disparities are also of serious nature in relation to socio-economic infrastructural facilities. Inter-regional disparities for certain selected indicators are shown in Appendix - 1. The extent of these disparities provides adequate basis to indicate that the existing practice of viewing the State as an entity comprising five economic regions - Western, Central, Eastern, Bundelkhand and Hills (Map - 1), needs reconsideration since these do not have the characteristics of homogeneity in terms of either the resource base or the level of development.

The above situation calls for a radical change in the approach towards balanced regional development. It is necessary to optimise the overall growth rate by taking appro-

priate measures on the basis of the scope for functional specialisation provided by regional variations in resource endowments, infrastructure and agro-climatic conditions. It would also be necessary to develop sequential location specific strategies which by way of maximum possible exploitation of local potentials will help reduce the existing disparities. In the light of these functions the major tasks of regional development policy[4] could be envisaged as follows :

i. Regions have to be clearly demarcated;

ii. A strategy of development of different regions has to be formulated separately;

iii. Strategies for development of different districts have to be chalked out;

iv. Elaboration of the strategy into detailed plans and programmes to fit into state sectoral plans should be done; and

v. The regional strategies should be incorporated into the development strategy at the State level.

In order to accomplish the above mentioned tasks, a multi-level planning framework[5] has to be developed in such a manner that there would be a continuum from the block as a unit of planning right upto the state level. The present paper is, however, concerned with mainly the first and the foremost task, i.e. clear cut demarcation of planning regions.[6]

II OBJECTIVE AND METHODOLOGY

i. Objective

With a view to providing a pragmatic approach to balanced regional development, attempt has, therefore, been made in the present paper to classify all the districts of Uttar Pradesh into broad homogeneous groups (i.e. planning regions) and highlight salient features of each of the identified planning regions. Such classification would reveal imbalances in levels of economic development, resource base and institutional structure and enable authorities concerned to evolve suitable policies to eliminate the existing imbalances in future. This will also help in formulating regional development strategies which, in turn, would provide pre-requisites for drawing development strategies at the district level.

ii. Choice of indicators

In all, 38 indicators have been selected for the purpose of detailed analysis. These indicators have been classified into three major groups, i.e. economic development, resource base and the institutional structure. Out of these indicators, 19 have been selected for showing the regional contrasts in respect of socio-economic development, 14 indicators are concerned with the resource base and the remaining five have been chosen for showing district-wise pattern of institutional structure. A list of these selected indicators is placed at Appendix - 2.

The resource base indicators are taken to convey the extent of availability and utilisation of natural resources, such as land, forest, surface and ground water, livestock and manpower.[7] For instance, proportion of forest to total reporting area indicates the existing or probable significance of forestry in the activity structure and scope for development of forest based industries in the area. The percentage of culturable waste and other fallow land to total geographical area indicates the extent and the possibility of increasing area under cultivation. The percentage of unutilised irrigation potential and balance of ground water resources reveal the scope for development of irrigation. Similarly, the livestock population per ha. of geographical area shows the availability of animal power for agricultural operations and assets for development of animal husbandry and associated activities.

The indicators pertaining to institutional structure reflect attitude, motivation, aspiration and receptivity of the people towards innovative ideas and values which comprise the structural conditions, conducive or otherwise to a process of development.[8] For example, high proportion of scheduled caste and scheduled tribes population is likely to act as pulling down the growth and modernisation because of their poverty and low education. Likewise, higher percentage of illiteracy is indicative of lower aptitude and rather reluctance of people towards innovations. Lastly, the percentage of holdings below one ha. to total holdings helps in tracing out

the possibilities of mechanisation and adoption of modern practices in agriculture. Higher the percentage of holdings below one ha. to total holdings, lesser would be the scope for mechanisation and modernisation of agriculture.

The indicators selected for depicting the levels of development concern with four major sectors of the economy, i.e. agriculture, industry, transport & communication and social services.[9] Here the value of agricultural produce per ha. of net area sown has been taken to show the effectiveness of agricultural operations in socio-economic development. Intensity of cropping tells us about the scope of bringing additional area under multiple cropping. The indicators of high yielding varieties to gross cropped area, consumption of fertiliser per ha. of gross cropped area and consumption of power per ha. in agriculture have been selected as complementary inputs which help in modernising the agriculture. The percentage of area under commercial crops to gross cropped area provides the level of diversification in agriculture and efficiency of farm management. For the industrial sector, output per worker has been considered as a measure of industrial productivity which also gives some idea about the efficiency of industrial workers. The indicators of economic infrastructure, which play pivotal role in agricultural and industrial development, have been selected for showing inter-district disparities in the level of its development particularly roads and power. Lastly, the literacy percentage is

selected as an indicator to show the level of educational development which is deemed to have a direct association with willingness of the people for adoption of new programmes especially those based on modern technology.

iii. Sources of Data

The paper is based on the data collected from secondary sources for the selected indicators of economic development, resource base and institutional structure. Population statistics have been compiled from the Census of India, 1971, Series 21, Uttar Pradesh, Part II-B(1) Economic Tables, whereas those regarding the land holdings from Agriculture Census, Uttar Pradesh, 1970-71. Some of the important indicators for which data have been obtained from Economics and Statistics Division of the State Planning Institute, Lucknow relate to value of agricultural produce per ha. of net area sown, value of industrial output per industrial worker, electricity/power, road, education and health. The other departments of the State Government which have supplied data for this purpose include Agriculture, Irrigation, Ground Water Resources and Animal Husbandry.

iv. Methodology

Since the problem of delineation of planning regions in the present case is associated with two dimensions, i.e. set of variables (indicators) and observations (districts), two statistical methods can be considered suitably meaningful

from the view point of their applicability. First, certain weights for the variables can be estimated using the district-level observations on each of the variables and a weighted index of these variables can be constructed. Using these weights, the observations on all the variables (or the relevant ones) can be aggregated for each district. Such weighted aggregate index for each district can be taken as a measure of the district's overall performance. Thus, if we combine the resource base variables using these weights, the index can be called as a measure of aggregate resource base. The relative values of these weighted indices for the districts are indicators of performance, potential or impediment to development. This approach is known as factor analysis. In factor analysis, the weights or factor loadings are estimated using the method of principal components. In brief, the approach is to group the variables (known as factors) with certain weights, and rank the districts according to the weighted index.[10]

Alternatively, one can consider the possibility of grouping the districts based on the concept of homogeneity and rank the groups of districts according to a hierarchy of aggregated performance of different indicators. This approach is known as taxonomical or clustering technique.[11] This method has been adopted for analysing the data in the present context, a detailed methodological account of which is given below.

The problem before us is how can we identify groups of districts which are quite similar within each group. As a matter of fact, no two districts are exactly alike as measured by an indicator. For example, among the hill districts, even two of them are not exactly alike in their resource base. Forest as percentage to total reporting area is 64.3 per cent in Dehradun and 88.5 per cent in Uttar Kashi but 68.9 per cent in Pauri-Garhwal. If we take percentage of labour force to total population, Uttar Kashi occupies first position with 53.86 per cent; whereas in Nainital it is 29.23 per cent only. But values of these two variables are quite different for a district like Saharanpur with respective percentages of 14.0 and 24.77 or Meerut with 1.7 and 23.49. Then, can we say that all the Hill districts are quite similar in their resource endowments? Can we say that Dehradun, Nainital and Saharanpur are alike? Taxonomy is an attempt to answer these questions.

Clustering technique is a statistical tool to group the districts in several exclusive clusters such that with each group certain amount of homogeneity is attained. Following this, a second question can be asked. Can we obtain groups of similar districts such that at the same time every group (cluster) is made as distant as possible. This technique tries to do precisely the same. The distance between any pair of clusters is made as large as possible, while maximising the degree of homogeneity within each cluster.

In this way, some kind of regional hierarchy is obtainable in respect of the selected indicators. Thus, using agricultural development indicators, clusters can be derived such that within each cluster the districts are quite alike and between clusters the disparity in agricultural development is made very distinct; so that one can identify the least developed region, medium and well developed regions and so on.

The significance of cluster technique lies essentially in its application for policy purposes. First, having obtained groups of similar districts, the planning problems of such homogeneous districts can be studied separately for each cluster. Since the districts in each cluster have indicator-wise similarities, common problems of the districts falling in each group are more easily identifiable. The hierarchy of cluster regions makes such crucial problems distinct. For example, if Bahraich, Jalaun and Jhansi form one cluster of lowest order, with respect to agricultural development, it is mainly because of lower levels of area under high yielding varieties, intensity of cropping, irrigation facilities and consumption of fertilizers per hectare.

The clusters have two measures of hierarchy known as cluster centroids and distances of cluster centroids from state level vector means. The cluster centroids are the means of the variables within each cluster. The cluster distance is an indication of how far distinct any cluster is

from a state level average. Thus, a comparison of mean of, say, per capita expenditure on non-food items of one cluster with that of another cluster itself will reveal whether the districts in the two clusters are similar with respect to this variable. Likewise, comparison of variable means between clusters will highlight the district-wise problems more clearly. The cluster distances from the state level are comparable between clusters. If the distances of first and fourth clusters from the state level are 1,000 and 200 respectively, it can be inferred that the first cluster is quite distinct from the fourth. If any two such distances are somewhat alike such clusters can be assumed to be similar or equivalent.

The method of clustering can be briefly described without much of mathematical symbols and expressions. Let 'M' number of variables be measured on 'D' number of districts which are to be grouped into 'N' clusters. A set of 'N' initial cluster centroid vectors or 'NM' cluster means be defined as follows :

$\bar{X}^{\circ}_{ij}$, i = 1, 2 .. N, j = 1, 2 .. M are the fractile means for the variable j grouped into ith fractile. In other words, for each variable, the district observations are ranked in ascending order and N partitions of (preferably) equal number of observations are made. The mean of ith partition for any variable j is $\bar{X}^{\circ}_{ij}$. These are only the initial guesses of cluster centroids for obtaining final clusters.

Thus $(\bar{X}^{\circ}_{i1}, \bar{X}^{\circ}_{i2}, \bar{X}^{\circ}_{iM})$ is a vector of ith cluster centroids. Because of fractile group approach, these centroids of different clusters are in an ascending order of their values and hence they represent some sort of hierarchical pattern. Each district observation on the M variable X_{jk}, j = 1, .. M, k = 1, .. D is tested for its closeness to any of these N cluster centroids. Let a distance function D_{ik} be defined between ith cluster centroid and kth district observation as :

$$D_{ik} = \sum_{j=1}^{M} (X_{jk} - \bar{X}^{\circ}_{ij})^2 \qquad .. (1)$$

$$i = 1 \quad .. N$$

$$k = 1 \quad .. D$$

The district k is allocated to ith cluster if this distance is minimum among D_{ik}, D_{2k}, ... D_{Nk}. In other words, a minimum of D_{ik} for i = 1 .. N determines the closeness between any district k and the ith cluster centroid. Thus, all those districts so grouped around ith cluster centroid form a cluster with their inter-district distances minimised. Since the districts are assigned to a particular cluster on the basis of Euclidean distance function given above at (1), they remain quite homogeneous (similar) among themselves. During the course of this process, all the districts have been assigned to one cluster or the other.

The means for each variable over all observations (districts) falling in each cluster are then recomputed. Let $\bar{X}^{1}_{ij}$ be the first round (iteration) cluster centroids. These

means are the new cluster centroids pertaining to the districts falling in each cluster. Having these cluster centroids of first iteration, a second round (iteration) is followed to search if any district which falls in a cluster say -1 can be regrouped into other clusters. In other words, once again the distance matrix, D_{ik} defined in equation (1) is estimated using the first iteration cluster centroids $\bar{X}^1_{ij}$ in place of $\bar{X}^0_{ij}$. District k is assigned cluster i if D_{ik} is minimum among all D_{ik} for i = 1 .. N. At the end of this iteration, all the districts will be reassigned to one cluster or the other.

The process is repeated again as a third iteration and so on. The clustering is final only when no further shift or reassignment of districts is possible.

There is a basic limitation of this method arising out of different dimensions of the variables. For example, value of agricultural produce per hectare is in terms of rupees, while crop itensity in percentage and so on. Then the distance function D_{ik} will be subjective, depending upon the units of measurement used for the variables. One practical way to overcome this problem is to scale or standardise the observations. The following standardization is preferable :

$$\text{Define } X_{jk} = \frac{X_{jk} - \bar{X}_j}{S_j} \qquad .. (2)$$

Where $\bar{X}_j$ is the overall (state level) mean of variable j and S_j is the standard deviation for variable j. They are defined as :

$$\bar{X}_j = \frac{1}{D} \sum_{K=1}^{D} X_{jk} \qquad .. (3)$$

$$S_j^2 = \frac{1}{D} \sum_{K=1}^{D} (X_{jk} - \bar{X}_j)^2 \qquad .. (4)$$

In as much as standardization of variables is useful to eliminate the effects of measurement, (i.e., problem of Units), it neutralises district-wise variation (i.e., variance of standardised variable is unity) which is the basis for grouping the districts. Hence, for cluster analysis, as far as possible, attempts should be made to measure all the variables in the same units say Rs. or Kg. etc., in which case standardization is not necessary. In the event, variables cannot be measured in the same units, transformation of the variables to obtain standardized units should be performed as a second best alternative.

The clustering method begins with a hierarchy of N initial cluster centroids. Any assignemnt and reassignment are performed around these initial cluster centroids. This ensures some kind of regional hierarchy of the final set of clusters. A measure of the hierarchy is the distance between the cluster centroids and the overall means for the entire state. Let such a cluster distance be defined as :

$$D_i = \sum_{j=1}^{M} (\bar{X}_{ij} - \bar{X}_j)^2 \qquad .. (5)$$

$$i = 1 \quad .. N$$

It is the Euclidean distance between the ith cluster centroid vector ($\bar{X}_{i1}$, $\bar{X}_{i2}$ ... $\bar{X}_{im}$) and state average vector ($\bar{X}_1$ ... $\bar{X}_m$). The ranking off these cluster distances is an indication of regional hierarchy. The present clustering technique invariably ensures the hierarchy of clusters, i.e., cluster number one is at the bottom or the lowest level, cluster N is at the top or the highest level, etc.

The degree of similarity between districts within each cluster can be measured by 'within' cluster distance. The within cluster distance WD is the average distance of all those districts falling in a cluster from its centroid defined as :

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$$WD_i = \frac{1}{N_i} \sum_{k=1}^{N_i} \sum_{j=1}^{M} (\bar{X}_{kj} - \bar{X}_{ij})^2 \qquad .. (6)$$

$$i = 1 \quad .. N$$

where, N_i are number of districts falling within ith cluster $\left(\sum_{i=1}^{N} N_i = D \right)$.

The logic of grouping the districts into clusters should also enable the researcher to merge some neighbouring clusters if required. Merging of nearby clusters is practical for drawing policy measures based on such merged planning or administrative clusters. Merging be allowed whenever the distance between two cluster centroids (i.e., between the two clusters) is minimum. Since the number of districts falling

in each cluster differs from one cluster to another, the following statistical formula is proposed to find out the minimum distance between clusters :

$$BD_{ik} = \frac{n_i \, n_k \, D_{ik}}{n_i + n_k} \qquad .. (7)$$

where, n_i = number of districts in cluster i.
n_k = number of districts in cluster k.
D_{ik}= distance between clusters, i and k
defined as :

$$D_{ik} = \sum_{j=1}^{M} (\bar{X}_{ij} - \bar{X}_{kj})^2 \qquad .. (8)$$

where $\bar{X}_{ij}$ and $\bar{X}_{kj}$ are cluster centroids for jth variable. Whenever this cluster distance BD_{ik} is minimum as compared to other pair-wise distances, the two clusters qualify for a merger.[12]

III CLASSIFICATION OF DISTRICTS BY HIERARCHY OF CLUSTERS

On completing the iterative process, the final cluster means are used to work out distance(variance) within and between the clusters. These distances together with cluster mean help in studying the features of each cluster and to know how far individual clusters are away from or proximate to the general mean of all the observations. Cluster centroids and vector means for the selected indicators in respect of economic development, resource base and institutional structure are given in Appendix - 3. These cluster centroids show the hierarchical pattern of development. Classification of districts into different clusters for U.P. based on the principle of Euclidean Cluster Analysis is given in the following table.

Table - 1

Classification of Districts by Hierarchy of Clusters with Respect to Selected Indicators at Economic Development, Resource Base and Institutional Structure :

Clusters	Economic Development (Map - 2)	Resource Base (Map - 3)	Institutional Structure (Map - 4
1	2	3	4
I	1. Mirzapur 2. Ghazipur 3. Raebareli	-	1. Pithoragarh 2. Chamoli 3. Uttar Kashi
II	1. Varanasi 2. Jaunpur 3. Fatehpur 4. Jalaun 5. Jhansi 6. Almora 7. Pauri-Garhwal 8. Pithoragarh 9. Chamoli	1. Almora 2. Pithoragarh 3. Chamoli 4. Tehri-Garhwal 5. Pauri-Garhwal 6. Uttar Kashi	1. Mirzapur 2. Hamirpur 3. Jhansi 4. Almora 5. Nainital 6. Pauri-Garhwal 7. Tehri-Garhwal
III	1. Bijnor 2. Ballia 3. Deoria	1. Etah 2. Badaun 3. Farrukhabad 4. Varanasi 5. Jaunpur 6. Faizabad 7. Deoria	1. Pilibhit 2. Lakhimpur-Kheri 3. Jalaun 4. Dehradun 5. Banda
IV	1. Etah 2. Gorakhpur 3. Azamgarh 4. Gonda 5. Sultanpur 6. Pratapgarh 7. Barabanki 8. Unnao 9. Hamirpur	1. Gonda 2. Bahraich 3. Lakhimpur-Kheri 4. Banda 5. Hamirpur 6. Jalaun 7. Jhansi	1. Shahjahanpur 2. Bahraich 3. Fatehpur

1	2	3	4
V	1. Bareilly 2. Bahraich 3. Banda 4. Tehri-Garhwal 5. Uttar Kashi	1. Shahjahanpur 2. Pilibhit 3. Rampur 4. Ballia 5. Basti 6. Sultanpur 7. Pratapgarh 8. Barabanki 9. Fatehpur 10. Unnao 11. Raebareli 12. Sitapur 13. Hardoi	1. Mathura 2. Mainpuri 3. Bijnor 4. Badaun 5. Etawah 6. Gonda 7. Unnao 8. Raebareli 9. Sitapur 10. Hardoi
VI	1. Mathura 2. Mainpuri 3. Badaun 4. Pilibhit 5. Sahajahanpur 6. Farrukhabad 7. Etawah 8. Allahabad 9. Basti 10. Faizabad 11. Sitapur 12. Hardoi 13. Lakhimpur-Keri	1. Saharanpur 2. Agra 3. Bareilly 4. Bijnor 5. Moradabad 6. Etawah 7. Allahabad 8. Ghazipur 9. Gorakhpur 10. Azamgarh 11. Kanpur 12. Lucknow	1. Saharnpur 2. Etah 3. Rampur 4. Farrukhabad 5. Sultanpur 6. Pratapgarh 7. Barabanki
VII	1. Saharanpur 2. Muzaffarnagar 3. Kanpur 4. Lucknow	1. Muzaffarnagar 2. Meerut 3. Bulandshahr 4. Aligarh 5. Mathura 6. Mainpuri	1. Muzaffarnagar 2. Bulandshahr 3. Aligarh 4. Bareilly 5. Moradabad 6. Allahabad 7. Basti 8. Faizabad 9. Ghazipur
VIII	1. Bulandshahr 2. Aligarh 3. Agra 4. Rampur 5. Nainital	1. Mirzapur 2. Nainital 3. Dehradun	1. Agra 2. Jaunpur 3. Ballia 4. Gorakhpur 5. Deoria 6. Azamgarh 7. Kanpur
IX	1. Meerut 2. Moradabad 3. Dehradun	-	1. Meerut 2. Varanasi 3. Lucknow

IV PLANNING REGIONS IN U.P.

i. Criteria

A balanced regional development strategy for the district within such planning regions is the ultimate aim. The strategies will have to be translated into action through projects and schemes at the district level. Since monitoring and implementation of such projects require administrative machineries, the delineated planning regions should be feasibly operational from the view point of administrative convenience. Thus, geographical contiguity is an essential criterion which should occupy an important place in identification of planning regions.

The districts have by now been identified by their levels of economic development, resource base and institutional structure, using cluster technique. Quite often, geographically contiguous districts are also similar in socio-economic and cultural patterns. Homogeneity of districts with respect to these socio-economic factors is the second criterion in defining planning regions. For example, Badaun, Etawah and Farrukhabad are all at low level in resource base and at medium level in both the institutional structure and economic development. Hence, these three districts are quite homogeneous. Being geographically contiguous, these districts can also form a separate planning region. Another criterion is the feasible regional co-operation in pooling resources to evolve a balanced pattern of growth. In other words, it should be feasible for

a backward district in any planning region to draw upon the resources from its forward districts to raise its socio-economic status.

An added feature of a planning region is the spill-over effects between districts. Such effects could be prospective as in industrial complex analysis, or disadvantageous. Schemes and projects in resource-rich districts can provide job opportunities for the unemployed persons of neighbouring districts; supportive activities can be encouraged in the deficit districts within a planning region. For example, much of the industrial complex in Lucknow and Kanpur districts can be supported by a spring of small tool and engineering fabrication units in the districts of Unnao. Certain infra-structural activities like highway building, bridge, new rail link or power supply do have considerable amount of spill-over effects. For example, both Fatehpur and Raebareli have remained at a low level of development due to several factors, a major one being the absence of Gagason bridge over the river Ganga in Raebareli. With the completion of this bridge, these districts will have a direct transportation link with Lucknow and Allahabad. Such infrastructural development itself would raise the economic level of these two districts.

Thus, the criteria to be considered for identification of planning regions should include (i) administrative convenience, (ii) homogeneity, (iii) eco-system cohesion, (iv) complementarity, (v) viability and (vi) functional linkages.[13] When these

alternative criteria are employed to define planning regions, three distinct categories of planning regions would emerge. The planning regions based on purely coherence and homogeneity fall in the first category. Whenever such homogeneity among districts does not pertain, adjacent districts which are marginally different from each other may be merged. Such planning regions will be called composite homogeneous regions. The third category of regions consists of districts that may not be strictly coherent or homogeneous but are geographically, topographically and agro-climatically contiguous.

ii. Delineation of Planning Regions

Efforts have been made here to identify planning regions in the context of U.P., using the main findings of cluster analysis pertaining to economic development, resource base and institutional structure. Among the planning regions, as stated above, some of them may be designated as 'distinct regions', some of them may be called 'composite homogeneous regions' and the remaining ones may be placed in the category of 'other regions'. Conceptually, distinct regions are defined as those which have complete homogeneity with respect to economic development, resource base and institutional structure. Whereas composite homogeneous regions are those which possess characteristics of maximum possible homogeneity in respect of these three aspects. The planning regions which are not covered under the above two definitions, have been placed under the category of 'other regions', geographical contiguity, topography and agro-climatic conditions have been the main considerations

in such classification. As shown below, all the 54 districts of U.P. have been divided into 14 planning regions which are grouped into three categories of distinct, composite homogeneous and other regions.

Table - 2 : Identified Planning Regions

Identified Planning Regions/Districts (Map - 5)	Perfect Homogeneity in Respect of	Reasons of Inclusion
1	2	3
I. Distinct Regions		
1. Muzaffarnagar, Bulandshahr, Aligarh and Meerut (4)	E.D., R.B., I.S.	Complete homogeneity or coherence
2. Badaun, Etah and Farrukhabad (3)	E.D., R.B., I.S.	Complete homogeneity or coherence
3. Fatehpur and Raebareli (2)	E.D., R.B., I.S.	Complete homogeneity or coherence
II. Composite Homogeneous Regions		
4. Jhansi, Jalaun, Hamirpur, and Banda (4)	R.B., I.S.	Homogeneity with marginal variations in E.D.
5. Mathura, Agra, Mainpuri and Etawah (4)	E.D.	Homogeneity with marginal variations in R.B., and I.S.
6. Kanpur, Unnao and Lucknow (3)	R.B.	Homogeneity with variations in E.D. and I.S.
7. Barabanki, Faizabad, Sultanpur, Pratapgarh and Allahabad (5)	E.D.	Homogeneity with marginal variations in R.B., I.S., and geographical contiguity
8. Gorakhpur, Deoria, Azamgarh, Ballia and Ghazipur (5)	I.S.	Homogeneity with marginal variations in E.D. and R.B.

1	2	3
9. Saharanpur, Rampur, Moradabad and Bijnor (4)	R.B.	Homogeneity with marginal variations in E.D., I.S., and geographical contiguity
10. Bareilly, Pilibhit, Shajahanpur, Hardoi and Sitapur (5)	E.D., R.B.	Homogeneity with marginal variations in I.S.
III. Other Regions		
11. Lakhimpur-Kheri, Bahraich, Gonda and Basti (4)	E.D., R.B.	Homogeneity with marginal variations in I.S. and similarity in agro-climatic conditions
12. Jaunpur, Varanasi and Mirzapur (3)	E.D.	Homogeneity with marginal variations in R.B., I.S., and geographical contiguity
13. Dehradun, Uttar Kashi and Tehri-Garhwal (3)	I.S.	Homogeneity with variations in E.D., R.B., and geographical contiguity and topography
14. Nainital, Almora, Pauri-Garhwal, Chamoli and Pithoragarh (5)	I.S.	Homogeneity with variations in E.D., R.B. and geographical contiguity and topography

Note : 1. The abbreviations E.D., R.B. and I.S. used in the above table stand for economic development, resource base, and institutional structure respectively.

2. Meerut includes the new district of Ghaziabad carved out of the old Meerut and Bulandshahr districts, Jhansi includes Lalitpur district recently carved out of Jhansi district.

Thus, out of 14 identified planning regions there are three distinct, seven composite homogeneous and four other regions in the State. The districts of Muzaffarnagar, Bulandshahr, Aligarh and Meerut, which are part of the Western region,

form one distinct planning region because all these districts have perfect homogeneity in respect of economic development, resource base and institutional structure, besides geographical contiguity and similar agro-climatic conditions. On the basis of similar criteria two other compact areas (i.e., 'Badaun, Etah and Farrukhabad' of Western region and Fatehpur and Raebareli of Central region) have been designated as distinct planning regions. Moreover, seven out of the 14 planning regions are termed as composite homogeneous regions because these regions, apart from having region-wise similar topography, agro-climatic conditions and geographical contiguity, have shown only marginal variations in respect of one or two cases of economic development, resource base and the institutional structure.

One of the seven composite homogeneous regions covers all the four districts of the existing economic and administrative region known as Bundelkhand. These districts maintain perfect homogeneity in respect of resource base and institutional structure and only marginal variations in the levels of economic development occur mainly due to variations in the exploitation of existing resource potentials. Another important composite homogeneous planning region, which comprises Kanpur, Unnao and Lucknow districts of Central region, is the main industrial complex of the State. The districts of Barabanki, Faizabad, Sultanpur, Pratapgarh and Allahabad, which are the constituents of another composite homogeneous planning region,

belong to the Eastern region of the State and have attained similar level of economic development with only marginal variations in the availability of resource potentials. Besides, the disrticts of Bareilly, Pilibhit, Shahjahanpur, Hardoi and Sitapur form another composite homogeneous planning region which has complete homogeneity or coherence in respect of economic development and resource base with slight variations in levels of institutional structure. Saharanpur, Moradabad and Rampur have similar patterns of high resource endowments and have attained higher levels of development. The district Bijnor, which is comparatively less developed, has been pooled with these districts to form another composite homogeneous region because of the homogeneity in topography, climatic conditions, rainfall, etc.

The remaining four identified planning regions have been placed in the category of 'other regions' because of similarity in levels of economic development or institutional structure, geographical contiguity and similar physical conditions with variations in resource base. The districts of Nainital, Almora, Pauri-Garhwal, Chamoli and Pithoragarh, which constitute one such planning region, have complete homogeneity in respect of economic development, resource base and institutional structure except for the district of Nainital having attained a high level of economic development. This district functions as a nodal point and diffuses growth impulses to other districts of the region. Similar is the case with

Dehradun which provides stimulus for growth to neighbouring districts of Uttar Kashi and Tehri-Garhwal, thus constituting one region.

However, contrary to the above is the case of Mirzapur which has been clubbed with Jaunpur and Varanasi districts to form another planning region. This district is extremely backward in economic development and compares highly unfavourable with other constituents of the region, but is undoubtedly rich in resource potentials. Its link with Varanasi can bear better fruits taking the advantage of its resources and inter-district spill-over effects. Even multi-district projects in this region will prove advantageous. Lakhimpur-Kheri, Bahraich, Gonda and Basti all belonging to the Tarai Belt of the State are best suited to form one planning region. These districts have similarities in resource base as well as economic development.

V SALIENT FEATURES OF IDENTIFIED PLANNING REGIONS

The above identified planning regions are by their nature sub-regional areas of the State economy which should be used for the purposes of translating the State level objectives and targets into regional programmes and policies. Therefore, in the first instance, they must be capable to achieve the plan objectives which are essentially three, i.e., economic development, social justice and equity. To ensure this, it would be necessary to examine the availability of natural endowments, current status of socio-economic and physical

development and the resource potentials in these planning regions. These regions are used as means of developing the State economy by raising productivity to its maximum in each region with the ultimate objective of securing an appropriate balanced regional development. The regions should, therefore, have their own economic specialisations in the fields of agriculture, industry or other socio-economic and infrastructural activities. It is but natural that each region by virtue of its specialisation has some peculiar advantages which must be tapped effectively for accelerated and balanced development. It is, therefore, felt necessary to identify salient features or main characteristics of all the planning regions separately for formulating regional development strategies, which, in turn, will provide pre-requisites for drawing development strategies at the district level. For this purpose, all the 14 planning regions have been classified into highly developed, well developed, medium level of development - 1, medium level of development - 2, under-developed or developing and extremely backward categories with the help of certain important indicators of economic development and resource base. Such type of classification of planning regions is shown in the following table :

Table - 3 : Classification of Planning Regions by Their Levels of Development

Sl. No.	Planning Regions/Districts	Indicators of Development: Value of agricultural produce per ha. of net area sown ('000 Rs.) 1972-73	% of workers engaged in secondary sector to total workers 1971	% of villages electrified to total villages 1976	% of inhabited villages situated at less than 1 km. from pucca road 1976	Intensity of cropping 1974-75	% of net irrigated area to net area sown 1974-75
0	1	2	3	4	5	6	7
1.	Highly Developed						
i.	Muzaffarnagar, Meerut, Bulandshahr, Aligarh	H-1	H-2	H-1	H-1	H-2	H-1
2.	Well Developed						
ii.	Saharanpur, Bijnor, Moradabad, Rampur	H-2	H-2	H-2	M-1	M-2	M-1
3.	Medium Level of Development - 1						
iii.	Mathura, Agra, Etawah, Mainpuri	L-1	M-1	M-1	M-2	L-1	H-2
iv.	Lucknow, Unnao, Kanpur	M-2	H-1	M-2	M-2	L-1	M-2
v.	Janpur, Varanasi Mirzapur	L-1	H-2	M-2	H-1	L-1	M-2
4.	Medium Level of Development - 2						
vi.	Barabanki, Faizabad, Sultanpur, Pratapgarh, Allahabad	L-1	M-2	M-1	M-1	L-1	M-2
vii.	Bareilly, Pilibhit, Shahjahanpur, Hardoi, Sitapur	M-2	M-2	M-2	L-1	L-1	M-2

0	1	2	3	4	5	6	7
viii.	Badaun, Etah, Farrukhabad	M-2	L-1	H-2	L-1	M-2	M-1
ix.	Gorakhpur, Deoria, Azamgarh, Ballia, Ghazipur	M-2	M-2	M-2	H-2	L-1	M-2
5.	Developing or Underdeveloped						
x.	Uttar Kashi, Tehri-Garhwal, Dehradun	M-2	L-1	L-2	L-2	H-2	L-2
xi.	Chamoli, Pauri-Garhwal, Pithoragarh, Almora, Nainital	M-1	L-2	L-1	L-1	H-1	L-2
xii.	Lakhimpur-Kheri, Bahraich, Gonda, Basti	L-1	L-2	M-2	M-2	M-2	L-1
xiii.	Raebareli, Fatehpur	L-1	L-2	M-1	M-1	L-1	M-2
6.	Extremely Backward						
xiv.	Jhansi, Banda, Jalaun, Hamirpur	L-2	L-1	L-1	L-1	L-2	L-1

Note : Abbreviations H-1, H-2, M-1, M-2, L-1 and L-2 as recorded in the above table stand for High-1, High-2, Medium-1, Medium-2, Low-1, and Low-2 respectively.

1. Highly Developed Regions

(i) Thus, it is observed that the planning region constituted by Muzaffarnagar, Meerut, Bulandshahr and Aligarh districts is the most developed region among all the 14 planning regions of the State. In this region, the level of agricultural productivity is found at the maximum with high concentration of wheat and sugarcane areas. The value of agricultural produce

per ha. of net area sown in this region during the year 1972-73 accounted for Rs.3,460. Barring hill areas, the highest level of cropping intensity in this region during 1974-75 was the outcome of the highest percentage of net irrigated area to net area sown (85.30) and the effective implementation of Intensive Agriculture Area Programme (IAAP). The region is also advanced in the matter of industrial development. The percentage of workers engaged in secondary sector to the total workers during 1971 was 13.36 which compares very well with the corresponding percentage of 13.65 for the industrially most forward region of the State constituted by Kanpur, Unnao and Lucknow districts.

For overall and balanced development, it would now be appropriate to assign the highest priority to this region for industrial development. The establishment of village and small scale industrial units will help a lot in creating additional employment opportunities to unemployed/under-employed persons of the region, besides generating sources of additional income to the progressive entrepreneurs. The region is highly productive and most efficient in exploitation of the existing resource potentials with an excellent support of infrastructural facilities of the highest order. This is also the most advanced region of the State in the matter of rural electrification and road infrastructure. The percentage of villages electrified to the total villages in the region during 1976 was maximum (57.94) with the highest per-

centage of inhabited villages situated at less than one km. from pucca road (32.68).

2. Well Developed Region

(ii) A well developed planning region of the State is constituted by Saharanpur, Bijnor, Moradabad and Rampur. The region is quite advanced in the matter of agricultural and industrial productivity. The value of agricultural produce per ha. of net area sown in the region during 1972 was Rs.2,660 and the percentage of workers engaged in secondary sector to the total workers was 11.59, which is slightly lower than the corresponding figure of the industrially most developed region. Wheat and sugarcane are the two important crops of the region. The intensity of cropping in the region during 1974-75 was 137.39 per cent and the percentage of net irrigated area to net area sown was 51.95. Additional irrigation potential can further be developed by installation of State and private tube-wells, taking into account the balance of underground water resources available in the region. This will help in increasing intensity of cropping by way of intensive use of agricultural practices.

The region is also well advanced in the matter of infrastructural facilities. The percentage of villages electrified to total number of villages during 1976 was 46.52 and the percentage of inhabited villages situated at less than one km. from pucca road was 24.37.

3. Regions Having Medium Level of Development - 1

(iii) Another planning region constituted by Lucknow, Unnao and Kanpur districts has attained medium level of development - 1 and is designated as industrially most advanced region of the State. Although value of agricultural produce per ha. of net area sown in the region is low (Rs.1,980) and also below the state average (Rs.2,100). Industrial activities are of promising nature in the sense that percentage of workers engaged in secondary sector to the total workers are the highest (13.65) among all the planning regions of the State. Large and medium scale industries specially textiles are mostly concentrated in Kanpur, which is one of the leading textile centres of India. Whereas the important amongst the industrial units functioning at Lucknow are Scooters India, Hindustan Aeronautics and Mohan Breweries. Unnao could not get success in setting up industrial units to a desired extent mainly because of being sandwich between the two important cities, i.e. Lucknow and Kanpur. Thus, migration of labour force from Unnao to mainly Kanpur is quite at large. In order, therefore, to develop Unnao district and bring it at par with average of the region, it would be essentially required to establish small scale and village industries (based on the labour intensive technology) which apart from providing sources of additional income to entrepreneurs will also generate employment opportunities, reducing efflux of labour force significantly.

Intensity of cropping in this region during 1974-75 was comparatively low (129.30) mainly due to lack of irrigation facilities, resulting in the low level of agricultural productivity. Thus, there is a wide scope for enhancing agricultural productivity by intensive use of agricultural practices which will essentially require installation of State and private tubewells for creation of additional irrigation potential, taking into account the balance of underground water available in the region.

The region is deficient in the matter of infrastructural facilities also. The percentage of villages electrified to the total number of villages in the region during 1976 was 23.40, which is far below the state average, i.e. 28.31. Whereas the percentage of inhabited villages situated at less than one km. from pucca road in the region during 1976 was 19.38 which is also lower than the state average, i.e. 22.54. Therefore, creation of additional infrastructural facilities should be taken up in the region on priority basis. This will work as beckon to boost up the regional economy.

(iv) Medium level of development - 1 is also found in a planning region constituted by Mathura, Agra, Mainpuri and Etawah districts. The region is characterised by the low agricultural productivity and high level of industrial activity with normal facilities of infrastructure. Although the percentage of net irrigated area to net area sown in the region during 1974-75 was high (65.86), intensity of cropping did not

show any appreciable increase, because of less exploitation of irrigation potential and low adoption of improved agricultural practices. Raising of agricultural productivity should, therefore, be taken up on priority basis.

(v) The districts of Jaunpur, Varanasi and Mirzapur, which form a planning region of medium level of development - 1, have low agricultural productivity in general because of low level of cropping intensity and lack of irrigation facilities. Moreover, the percentage of other fallows and culturable waste to total reporting area is quite high (10.60), which widens the scope for bringing larger area under plough. Thus, the agricultural production can be stepped up by both the intensive and extensive type of cultivation. The region is progressing well in industrial sector and the percentage of workers engaged in secondary sector to total workers is comparatively high (12.44). Road infrastructure is exceptionally good but the percentage of villages electrified to total villages is considerably low. In order, therefore, to boost up industrial activity in the region, rural electrification programme should receive priority in future.

4. Regions Having Medium Level of Development - 2

(vi) Another planning region, which comprises Barabanki, Faizabad, Sultanpur, Pratapgarh and Allahabad districts, is a part of Eastern region of the State and has attained medium level of development - 2. Agricultural productivity in this region is comparatively low mainly because of lack of irri-

gation facilities, resulting in the low intensity of cropping. There is a considerable amount of unutilised ground water potential which can be tapped alongwith new cropping pattern and increased land utilisation. Industrial activities in the region are of the lower order and below the state average. However, the availability of good infrastructure of roads and rural electrification is the healthy characteristic of the region for launching the campaign of Rural Industries Programme at massive scale.

(vii) The districts of Bareilly, Pilibhit, Shahjahanpur, Hardoi and Sitapur, which form another planning region, are parts of Western and Central regions. Agricultural development in this region being at medium level stands a good chance by bringing larger area under irrigation. The unutilised ground water potential is about 60 per cent in all the districts of this region except for Bareilly (40 per cent). Characteristically enough the growth of both organised industries and rural infrastructure have been lagging behind the state levels. Particularly rural electrification is the lowest next only to Hill and Bundelkhand regions. Thus, the region is deficient in infrastructural facilities and needs special treatment in future.

(viii) The planning region consisting of Gorakhpur, Deoria, Azamgarh, Ballia and Ghazipur districts is at the medium level in cases of both the agricultural and industrial development. Intensity of cropping for the region compares

well with the state level and irrigation facilities are around 50 per cent. In order, therefore, to enhance yields per ha., it would be imperative to create additional irrigation potential by way of installation of state and private tubewells which, in turn, will encourage adoption of new cropping pattern. Infrastructural facilities are also of medium type. The percentage of inhabited villages situated at less than one km. from pucca road during 1976 was as high as 29.06. In view of the availability of medium level infrastructural facilities, it would be desirable to set up both capital and consumer goods industries at suitable places in the region.

(ix) The constituents of another planning region are Badaun, Etah and Farrukhabad districts where agricultural productivity is at the medium level. This is also supported by the medium levels of cropping intensity and irrigation facilities. Thus, intensive use of cultivation is possible only through creation of additional irrigation potential and adoption of new cropping pattern which, in turn, will enhance not only cropping intensity but productivity level also. There is a good scope for extension of area under cultivation. The region is industrially backward and only 5.29 per cent of the total workers are engaged in industrial activity. Although implementation of rural electrification programme has created favourable environment for industrial development, inadequacy of road infrastructure has become an obstacle in the way of rapid industrialisation.

5. Developing or Underdeveloped Regions

(x) Out of the eight districts of hill region, Uttar Kashi, Tehri-Garhwal and Dehradun constitute one planning region, whereas the remaining five districts including Nainital form the other. The former region is characterised by the medium level of agricultural and industrial development. Intensity of cropping is quite high and its impact on agricultural productivity is fairly good. Here the forest resources are in plenty but owing to deficient infrastructural facilities, industrial units based on forest resources have not come up in a large scale. The raw materials mainly forest produce have generally been sold to outsiders for processing and manufacturing purposes and the persons residing within the region are deprived of both the income and employment opportunities. Thus, creation of additional infrastructure has become sine qua non for boosting up industrial activities in the region.

(xi) Above characteristics also held good in case of the other planning region constituted by the hill districts of Nainital, Almora, Pithoragarh, Chamoli and Pauri-Garhwal.

(xii) One of the underdeveloped planning regions falls in Tarai belt and includes Lakhimpur-Kheri, Bahraich, Gonda and Basti districts. The region is backward in both the agricultural and industrial development and existing economic infrastructure namely, roads and electricity, is quite insufficient to boost up the overall economy of the region.

(xiii) The districts of Raebareli and Fatehpur constitute another underdeveloped planning region of the state. Agricultural productivity is low mainly because of low level of cropping intensity and inadequacy of existing irrigation facilities. In view of these and considering the availability of good portion of land under fallows and culturable waste, it would be desirable to lay emphasis on both the intensive and extensive types of cultivation. Although existing infrastructural facilities are almost adequate and compare well with the state level, the region is extremely backward in the matter of industrial development.

6. Extremely Backward Region

(xiv) The last one, which is designated as extremely backward region of the state, is constituted by Jhansi, Banda, Jalaun and Hamirpur districts. Agricultural productivity of the region is extremely low because of the low level of cropping intensity and lack of irrigation facilities. Thus, creation of additional irrigation potential requires top priority for enhancing yields per hectare. Moreover, industrial activity is also at extremely low level because of deficient infrastructure especially roads and power.

VI CONCLUSION

As stated earlier, the sectoral approach to planning has resulted in lags between development and the utilisation of resources and capacities, widening of inter-regional dis-

parities in levels of development and heterogeneity in social structure of Uttar Pradesh during the period of planned development. In order to counteract these drawbacks, it is, therefore, recommended that the concept of multi-level planning should be introduced and the path of decentralised planning and decision-making be followed in an integrated manner for the accelerated and balanced development of Uttar Pradesh.

For this purpose, a set of identified planning regions, which has been suggested here with a view to designing the multi-level regional planning framework for the balanced economic development of Uttar Pradesh, would help in making choice of appropriate location specific strategies for the development of a spatial pattern of human activities leading to autonomous processes of socio-economic change in the desired direction. The regional development plans based on this exercise would basically be oriented to streamlining the order of human activities in a fashion that the resources - natural, human and others - are utilised to the maximum possible extent. As a sequel, the economy of each region would develop at an accelerated rate and fruits of social and economic development would be equitably distributed among the various groups of people. This would further narrow down the gap in achievements among different regions of the State. The development within each region would be so articulated and designed that it would lead to an increase in efficiency of investment and bring about an overall improvement in socio-economic conditions of the people.

However, formulation of the development strategy for different regions would involve inter alia certain major issues which will have to be tackled cautiously. First, since there is heterogeneity in major characteristics of different regions, diagnosis of problems and prescription of solutions would differ from one kind of region to another. For example, if out-migration is deemed to be the most effective remedy for the problems of one type of underdeveloped region, it does not automatically become an optimal course of action for the others. Therefore, major characteristics of individual regions will have to be kept in mind while identifying the problems, drawing up a list of objectives and determining priorities for formulation of comprehensive regional development plans.

Secondly, these regional plans should conceive goals and objectives of both national and regional levels. The pursuance of regional authority exclusively for purely intra-regional objectives might create conflict with the legitimate objectives of surrounding regions because of adoption of such measures which limit benefit spill-outs but stimulate benefit spill-ins. Thus, a development plan for an individual region geared to a set of regional objectives will have to be formulated within the parameters of national objectives of economic growth, social justice and environmental quality.

Finally, although the proposed planning regions have been delineated on the basis of the principle of Euclidean Cluster Analysis giving lion share to homogeneity criterion,

diaggregation of State plan at the regional level only will, although be necessary, but not sufficient condition for providing proper solution atleast to the problem of intra-regional disparities. This is obviously because of the fact that the availability of resource potentials and the level of development are not exactly of identical or homogeneous nature for all the districts constituting a particular region. In other words, the possibility of inter-district diversities in the availability of resource potentials and disparities in levels of development cannot be ruled out. It is, therefore, suggested to spell out inter-district differential strategies which should form the basis of formulating integrated area plans for the development of different districts.

Appendix - 1

Extent of Inter-Regional Disparities

Sl. No.	Regions	Forest as percentage to reporting area, 1974-75	Current Fallow and net area sown as percentage to reporting area, 1974-75	Percentage of balance of underground water resources to total safe yield, 1974-75	Density of population per sq. km. of area, 1971	Percentage of of area under holdings below one ha. to total holdings 1971	Value of agricultural produce per ha. of net area sown ('000 Rs.) 1972-73
0	1	2	3	4	5	6	7
1.	Western	4.67	75.42	35.45	381	17.11	2.49
2.	Central	5.09	69.27	59.73	343	24.15	1.92
3.	Eastern	9.70	67.91	51.66	387	27.72	1.74
4.	Bundelkhand	7.84	65.09	79.25	196	6.83	1.28
5.	Hill	65.93	13.79	82.88	75	12.43	2.45
6.	U.P.	17.20	60.50	49.81	300	20.50	2.01
7.	Maximum (District)	88.50 (Uttar Kasi)	85.50 (Mathura)	96.55 (Dehradun)	644 (Lucknow)	39.10 (Jaunpur)	4.32 (Meerut)
8.	Minimum (District)	0.00 (Ballia)	5.00 (Uttar Kashi)	0.00 (Agra)	19 (Uttar Kashi)	5.86 (Hamirpur)	1.08 (Jhansi)

Appendix - 1 (contd.)

Sl. No.	Regions	Percentage of net irrigated area to net area sown, 1974-75	Value of in-industrial output per industrial worker ('000 Rs.) (1973-74	Percentage of villages electrified to total villages, 1976	Length in km. of metalled roads per '000 sq. km. of area, 1975	Number of hospitals/dispensaries (Allopathic) per lakh of population, 1974
0	1	8	9	10	11	12
1.	Western	62.6	43.88	40.40	142.3	1.7
2.	Central	36.4	32.34	24.79	127.7	2.2
3.	Eastern	42.3	43.67	28.42	138.5	1.5
4.	Bundelkhand	22.0	12.49	16.70	97.1	2.3
5.	Hill	20.0	37.43	12.46	116.0	7.0
6.	U.P.	45.3	39.18	28.31	129.9	2.0
7.	Maximum (District)	87.0 (Meerut)	75.39 (Saharanpur)	77.02 (Muzaffarnagar)	242.7 (Dehradun)	11.3 (Dehradun)
8.	Minimum (District)	4.3 (Chamoli)	0.00 (Chamoli)	4.22 (Pithoragarh)	45.5 (Chamoli)	0.8 (Deoria)

Appendix - 2

List of Indicators Used in Cluster Analysis

A Resource Base

1. Area under forest as percentage to reporting area, 1974-75.
2. Culturable waste as percentage to reporting area, 1974-75.
3. Current fallows and net area sown as percentage to total reporting area, 1974-75.
4. Other fallows and culturable waste as percentage to reporting area, 1974-75.
5. Intensity of cropping, 1974-75.
6. Percentage of unutilised irrigation potential to total irrigation potential, 1974-75.
7. Percentage of balance of underground water resources to total safe yield, 1974-75.
8. Net irrigated area as percentage to net area sown, 1974-75.
9. Gross irrigated area as percentage to gross cropped area, 1974-75.
10. Percentage of area under commercial crops to gross cropped area, 1974-75.
11. Number of livestock available per ha. of geographical area, 1972.
12. Percentage of agricultural output to total net output, 1973-74.
13. Percentage of chronically unemployed and underemployed to total labour force, March 1978.
14. Percentage of labour force to total population in 1971.

B Institutional Structure

1. Density of population, 1971.
2. Percentage of scheduled caste and scheduled tribes to total population, 1971.
3. Percentage of rural population to total population, 1971.

4. Percentage of illiterates to total population, 1971.

5. Percentage of area in holdings below 1.00 ha. to total holdings, 1970-71.

C Economic Development

1. Value of agricultural produce per ha. of net area sown ('000 Rs.), 1972-73.

2. Intensity of cropping, 1974-75.

3. Percentage of area under High Yielding Varieties to gross cropped area, 1974-75.

4. Consumption of fertilisers per ha. of gross cropped area (in kg.), 1974-75.

5. Consumption of power per ha. in agriculture (KWH), 1974-75.

6. Percentage of irrigation utilised to total potential, 1974-75.

7. Percentage of net irrigated area to net area sown, 1974-75.

8. Percentage of area with holdings of three ha. and above to total area, 1970-71.

9. Percentage of area under commercial crops to gross cropped area, 1974-75.

10. Value of industrial output per industrial worker ('000 Rs.), 1974-75.

11. Consumption of electricity (in paise) per rupee value of industrial output, 1973-74.

12. Length in km. of metalled roads per 1000 sq. km. of area, 1975.

13. Percentage of inhabited villages situated at less than 1 km. from pucca road, 1976.

14. Percentage of villages electrified to total villages, 1976.

15. Literacy percentage, 1971.

16. Number of hospitals/dispensaries (Allopathic) per lakh of population, 1974.

17. Per capita (Rural) non-food expenditure (Rs. per day), 1969-70.

18. Per capita (total population) Non-food expenditure (Rs. per day), 1969-70.

19. Percentage of workers engaged in secondary and tertiary sectors to total workers, 1971.

Appendix - 3

Table - 1 : Cluster Centroids for the Selected Indicators of Economic Development

Clusters	No. of Districts	Value of agricultural produce per ha. of net area sown ('000Rs) 1972-73	Intensity of cropping (1974-75)	Percentage of area under high yielding varieties to gross cropped area 1974-75	Consumption of fertilizer per ha. of gross cropped area (in kg.) 1974-75	Consumption of power per ha. in agriculture (KWH) 1974-75	Percentage of irrigation utilized to total potential 1974-75	Percentage of net irrigated area to net area sown 1974-75	Percentage of area with holding 3.00 ha. & above to total area, 1970-71	Percentage of area under commercial crops to gross cropped area 1974-75
0	1	2	3	4	5	6	7	8	9	10
I	3	1.67	127.43	16.29	14.79	91.56	81.34	38.23	42.82	6.89
II	9	1.76	139.22	12.59	9.76	26.15	90.11	25.01	36.82	4.11
III	3	2.33	129.40	29.26	21.93	69.75	71.82	42.63	44.82	15.91
IV	9	1.72	129.40	26.49	15.81	47.95	90.11	42.63	36.82	8.28
V	5	1.73	135.29	13.52	5.59	4.34	91.57	20.61	40.82	6.89
VI	13	1.92	133.33	25.56	17.85	47.95	90.84	51.44	38.82	12.43
VII	4	2.92	137.25	25.56	28.07	91.56	96.69	55.84	46.82	19.38
VIII	5	2.54	147.08	31.12	25.00	69.75	93.03	60.25	52.82	17.30
IX	3	2.98	147.08	27.41	25.00	91.56	84.26	60.25	44.82	20.08
Mean Vector (U.P.)		2.04	135.29	22.78	16.83	47.95	89.38	42.63	40.82	11.05
Standard Deviation (U.P.)		0.6337	14.0209	9.6271	10.1090	46.6971	8.5550	20.9897	14.1458	8.3350

Appendix - 3 (contd.)

Clusters	No. of dist-ricts	Value of industrial output per industrial worker ('000Rs) 1973-74	Consumption of electricity (in paise) per rupee value of industrial output 1973-74	Length in km. of metalled road per '000 sq. km. of area, 1975	Percentage of inhabited villages situated at less than 1 km. from pucca road, 1976	Percentage of villages electrified to total villages, 1976	Literacy percentage, 1971	Number of hospital/dispensaries (allopathic) per lakh of population, 1974	Per capita rural non-food expenditure, 1969-70 (Rs. per day)	Per capita (total population) non-food expenditure 1969-70 (Rs. per day)	Percentage of workers engaged in secondary and tertiary sectors to total workers 1971
0	1	11	12	13	14	15	16	17	18	19	20
I	3	45.79	5.20	137.52	24.15	29.08	19.39	2.20	0.13	0.16	15.48
II	9	26.45	1.30	137.52	19.25	18.61	27.02	4.28	0.19	0.22	19.86
III	3	26.45	3.97	170.36	31.25	31.17	19.79	1.35	0.21	0.23	18.40
IV	9	36.12	1.97	137.52	21.43	24.89	18.18	1.56	0.23	0.24	14.02
V	5	32.90	0.40	104.68	13.79	16.51	17.79	4.01	0.25	0.26	12.57
VI	13	42.57	1.71	121.10	20.33	29.08	19.79	1.78	0.27	0.28	16.94
VII	4	42.57	2.18	170.36	29.61	47.93	29.03	2.58	0.26	0.35	41.75
VIII	5	36.12	0.95	153.94	24.15	43.74	23.80	2.68	0.35	0.36	31.53
IX	3	39.34	2.66	186.78	27.42	43.74	29.83	4.88	0.55	0.55	44.67
Mean Vector (U.P.)		36.12	1.91	137.52	21.97	29.08	22.20	2.68	0.26	0.28	21.32
Standard Deviation (U.P.)		17.9576	2.6217	40.5221	7.3889	14.4743	6.3382	2.3144	0.1067	0.1100	12.0798

Table

sters	No. of Dist-ricts	Gross irrigated area as percen-tage to gross cropped area (1974-75)	Percentage of area under com-mercial crops to gross crop-ped area (1974-75)	Number of live-stock available per ha. of geo-graphical area (1972)	Percentage of agriculture output to total net output (1973-74)	Percentage of unemployed & underemployed to total lab-our force (March 1978)	Percentage of labour force to total popu-lation (1971)
0	1	10	11	12	13	14	15
[illegible]	0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	6	12.17	2.48	0.73	72.90	3.78	41.38
IV	7	44.24	10.82	2.10	85.49	7.86	25.00
V	13	19.66	7.85	1.47	88.44	8.03	27.97
VI	12	36.70	9.88	2.06	91.08	6.97	26.05
VII	6	43.53	13.83	1.91	74.25	7.49	25.04
III	3	72.43	16.72	1.88	82.77	6.47	23.33
IX	0	30.57	13.18	0.93	66.17	6.02	29.81
		0.0	0.0	0.0	0.0	0.0	0.0
an Vector .P.)		37.89	10.74	1.73	81.95	6.88	27.55
andard viation (U.P.)		17.42	7.77	0.54	12.85	1.71	5.87